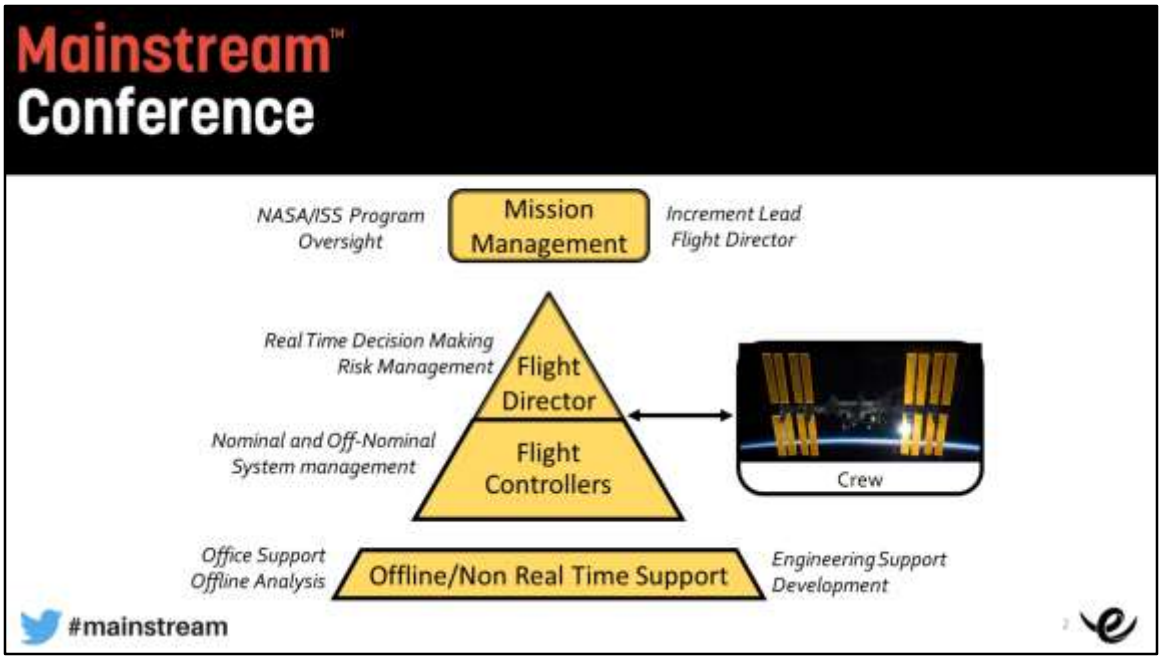
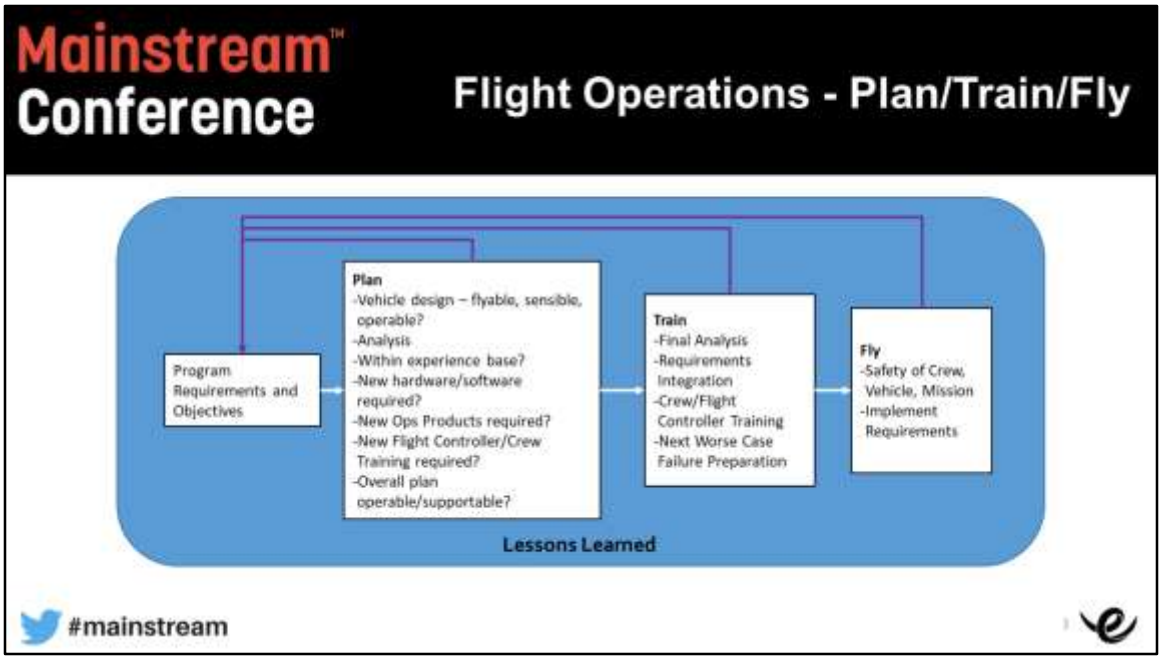
Presentation PET 0:00
40 minutes max for talking, leaving 10 minutes for Q&A.



0:02
Presentation PET 0:02

Talk about the various support positions, Flight being on top in the real-time environment. Also being managed by ISS Program and an Increment Lead FD that manages the strategic pieces of the ISS mission (next week, next month, next 3-6 months)



0:04
Presentation PET 0:06

Busy chart that tries to explain PTF. This is my own creation, not an official FOD/NASA chart, that tries to explain at a high level what PTF is/means. White lines are generally common to most orgs (take requirements, assess them, implement them, if it didn't work, do an 'after action'). Many orgs will also follow the purple feedback arrows – along every step of the way tell your requirement generators what will and won't work so they can do better, make changes, or tell you to do it anyway. More uncommon is doing Lessons Learned for successes as well as mistakes, and then implementing lessons learned back into every step of the process. This chart shows how we've operated human spaceflight missions from the very early days, evolving/refining as we've grown (and as we've failed/made mistakes).

All aspects of P/T/F embedded in Lessons Learned culture
- Encode, Duplicate successes
- Learn from, Avoid mistakes

All aspects of P/T/F provide feedback to the Program on the risks/concerns/recommendations of Program Requirements and Objectives

Mainstream™ Conference

Mission Control Center – Houston FCR-1, est. 1965

NASA's
"Leadership Laboratory"

#mainstream

0:01
Presentation PET 0:07
View of Flight Control Room 1 – the ISS control room in MCC-H. This is from the capture of the HTV4 mission, where I was lead Flight Director

Mainstream™ Conference

Inside Mission Control

Each console manages one subsystem

Flight Controllers

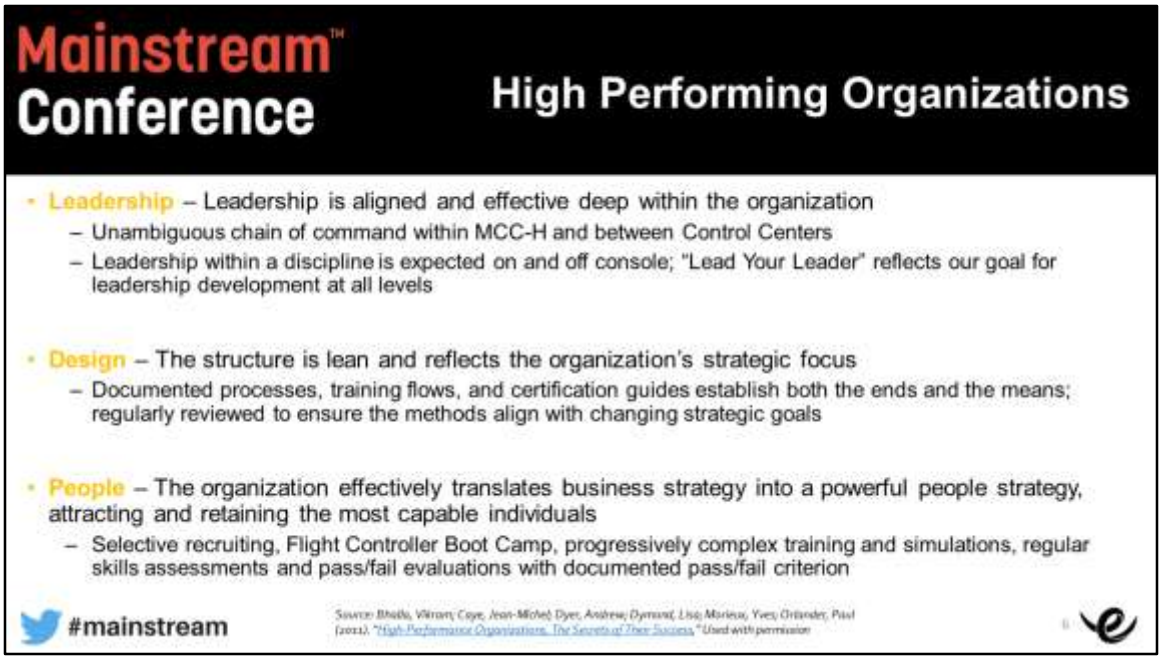
- Specialize in operations
- Complete a documented training and evaluation plan for MCC ops
- Divide time between office (plan, train) and console (fly)

#mainstream

0:01
Presentation PET 0:08

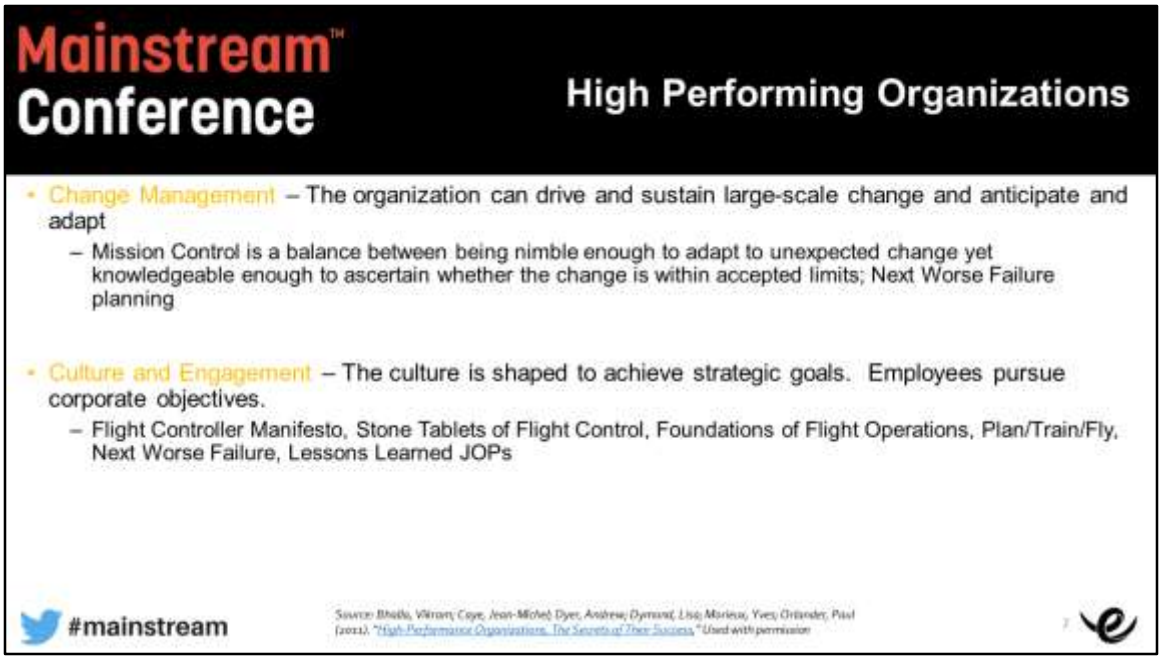
Photo is from when I was the Flight Director for the Planning Shift of STS-131. Shows how this is very much a team effort.
More about training later in the lecture

- Each console manages one subsystem (guidance, electrical, life support, timeline…)
- Flight Controllers
  - Specialize in operations
  - Complete a documented training and evaluation plan for MCC ops, most including multiple computer driven simulations
  - Divide time between office (plan, train) and console (fly)



0:03
Presentation PET 0:11

Define HPO: Formally, "A high performance organization is an organization that achieves financial and non-financial results that are better than those of its peer group over a period of time of at least five to ten years." Said in more laymen's terms – HPOs do good stuff faster and better than its peers. For us, it means we are very, very good at human spaceflight operations – but why are we good and how do we get and stay there, and how can it be applied to your group?
Talk about how Mission Control is a HPO by walking through the 5 characteristics of an HPO. The definition of each characteristic comes first, then I describe how we implement that characteristic.



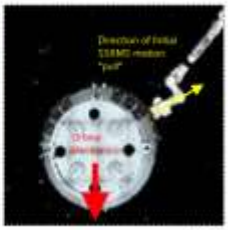
0:02
Presentation PET 0:13

Culture is part of FOD training from Day 1.

Mainstream™ Conference

Example: HTV-3's Abort

- August 2012: HTV grapple fixture stuck on the ISS robot arm as the arm backed away
  - Caused HTV to drift towards ISS, resulting in an unexpected automated abort
- HTV-4 scheduled for August 2013, 9 months later:
  - Don't let HTV-3 happen again!
  - What happened, why, how do we prevent it?
  - Cannot change HTV vehicle design
- ISS Program, Engineering, Flight Operations, Canada, Japan needed to fully engage
  - Key to on-time success – operating as a High Performing Organization
  - Assemble to agree on direction/priorities, release teams to do work, reassemble to assess/integrate results and agree on next step(s)



#mainstream

0:07
Presentation PET 0:20

Video source: YouTube, vides edited/compiled by myself duration 4:20
I've uploaded this video to YouTube as well: https://youtu.be/pYRTeudScHY

August 2012: HTV grapple fixture stuck on the ISS robot arm as the arm backed away causing HTV to drift towards ISS, resulting in an unexpected automated abort

Instead of slowly drifting away, HTV accelerated quickly away from ISS

August 2013: HTV-4 mission teams needed to understand the cause of HTV-3's abort, how to avoid this in the future, assess any impacts to proposed changes, develop new techniques and procedures, and be ready to fly in less than 1 year without changing HTV vehicle design

As a High Performing Organization, all involved parties across the ISS Program, Engineering, Canadian Space Agency, Japanese Aerospace Exploration Agency, and Flight Operations could integrate and lead their elements with only key management integration meetings required

Enabled accomplishing the aggressive mission schedule

▪Assemble to agree on direction/priorities, release teams to do work,

reassemble to assess/integrate results and agree on next step(s)

Needed CSA to determine what happened at the LEE/FRGF interface
Needed CSA and NASA Engineering to assess the forces and loads imparted on HTV
Needed JAXA to assess those loads and confirm that those loads caused the problem.
CSA and FOD ROBO needed to develop an alternate release technique
CSA and NASA needed to model what loads and moments the new technique would put into HTV
ISS Program asked for assessment of changing the HTV orientation – required JAXA, FOD, CSA, NASA Engineering assessment

Separately, HTV3 abort caused teams to assess the impacts of the thruster loads on ISS structure. Determined that for all possible abort trajectories there were loads and heating concerns. Needed to find a way to change the HTV release so that if there was a Main Engine abort, the thruster plume would not hurt ISS
NASA Structures, GNC, Aerothermal, JAXA, FOD VVO all involved

Ultimately came up with a release technique that used the sliding carriage to 'bump' HTV's grapple fixture out of the LEE if it didn't drift out prior to starting backaway. HTV design has it flying in a certain, fixed orientation relative to Earth. To get the thrusters pointed away from ISS structure, we also changed the ISS attitude at the time of release relative to HTV.

On release day, it all went exactly as simulated with one exception. When we got HTV to the release point, it was not where we thought it should be relative to ISS. It turns out that in some of the analysis, two numbers got transposed. Because of the type of leaders we develop in Flight Operations there as only a very brief "oh crap" moment and within 20 minutes our lead ROBO team determined the source of the problem, a means of correcting it, and developed a new procedure to move HTV to the correct position.

Best part – after we had a successful release and slow drift away, we all went for a round of beer to celebrate. ROBO stayed until he could track through the paperwork and find exactly where the error occurred and why. He joined us in about 1 hour's time. While we celebrated together, we also took notes on what processes we could improve to make sure this didn't happen again.

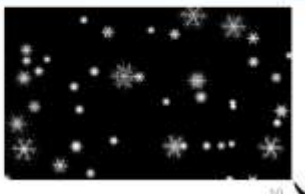
0:01
Presentation PET 0:21

Be here by 0:30
Define HRO: A **High Reliability Organization** (HRO) is an **organization** that has succeeded in avoiding catastrophes in an environment where normal accidents can be expected due to risk factors and complexity. Being an HPO is good but being good doesn't mean you get it right or you do it safely. HROs have a tendency to do thing safely and manage risk effectively. Typically HROs involve expensive, rare assets where their operations directly impact human lives. With lives of astronauts living in a tin can in the vacuum of space at stake, mission ops needs to be an HRO.

Mainstream™ Conference

Case Study US EVA 21, May 2013

- Crew reported 'snow flakes' outside
- MCC-H saw a large increase in a previously slow NH3 leak
- Program decided to execute a contingency spacewalk (EVA) in 2 days to replace a pump
- We had never done an EVA in so short a time!
  - EVAs typically take 12+ months to plan and train
  - "Critical Contingency EVAs" need at least 9 days
- Decision to do it so quickly based on
  - Catch the leak while it was still leaking
  - Before a crewmember returned to Earth in a Soyuz in 5 days

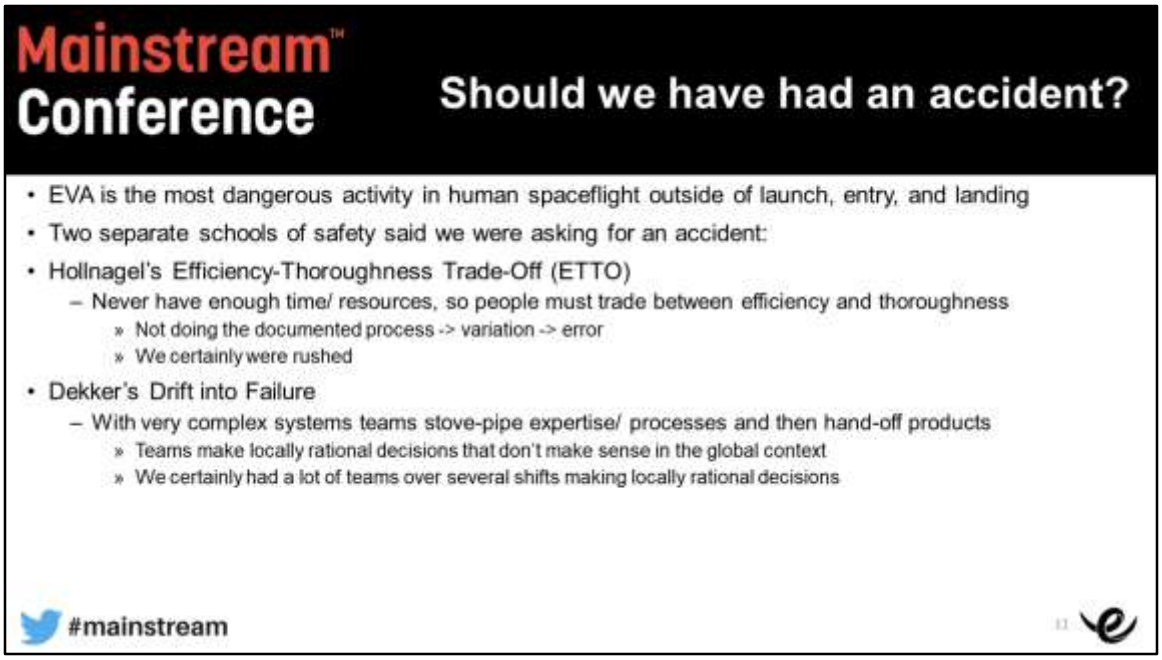


#mainstream

0:03
Presentation PET 0:24

There had been a slow leak for several years but the leak was so small that all we had to do was re-fill the NH3 every few years. But this was an order of magnitude bigger leak.

EVA 19 was a contingency EVA but we took about a week to plan it and it was basically a repeat of EVA 18, just trying to figure out how to drive some pesky bolts that wouldn't drive the first time



0:01
Presentation PET 0:25

0:01
Presentation PET 0:26

Mindful: sounds very New Age but is a very prominent term in safety theory: defined as a rich awareness of discriminatory detail; to notice the unexpected even through weak signals and to respond vigorously

We didn't get lucky. We very deliberately thought about the risks we'd need to manage if we were truly going to try to do an EVA in 2 days. We were mindful.

Mainstream™ Conference

CIRCUMSTANCES

- EVAs 18, 19 and 20 set us up
  - August – November 2012; one was contingency
- Many controllers had worked together
- Several had experience in contingency planning
- Astronauts were very experienced at this worksite
- Only leak location we could repair was the pump
- Flight controllers, Engineering, ISS Program Management were already familiar with the technical details

#mainstream

0:01
Presentation PET 0:27

EVAs 18 and 19: experience with 1 type of bolt
EVA 19: experience with planning a contingency EVA
EVA 20: experience at that work site & other bolt type

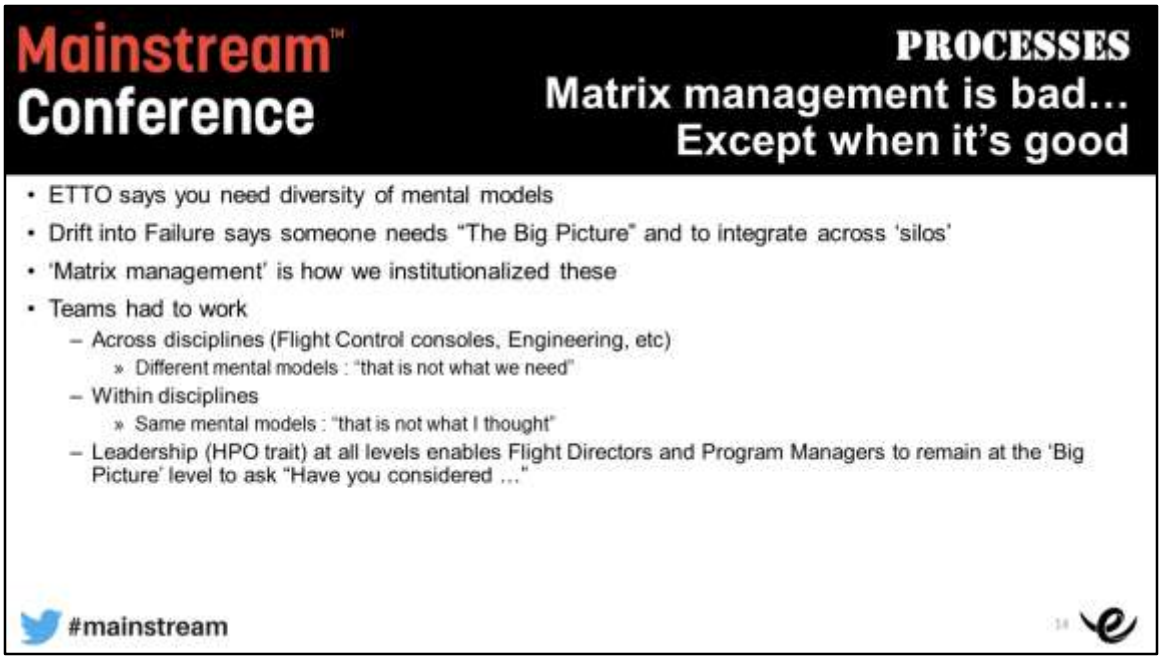
Contingency planning (EVA 19 and Big 13)

Finke was Ground IV and Hatfield was on-orbit IV, both with a tremendous amount of experience
Marshburn and Cassidy had done an eva to that general worksite on STS-127

There were 3 places where the leak could be. In the radiator (EVA 20 eliminated that as a possibility), in the pump or in the piping. If it was in the piping, it would be near impossible to find and even less likely to figure out how to fix. So it was the pump or nothing.

Spare pump located next to leaking pump

Because all the technical discussions around EVA 20 had to do with the PVTCS, everyone already knew what the technical details and issues were. There was no requirements to have multiple meetings to bring them up to speed. It allowed the Program Office to rapidly define a very limited scope for EVA 21: R&R the pump. That very limited scope allowed the team to very rapidly determine what they needed to do and what they didn't need to consider.



0:02
Presentation PET 0:29

Matrix mgmt: reporting to multiple bosses

Mental model (MM): how you think something should work. You have mental model about how to do your job, how to interact with your team members, etc.

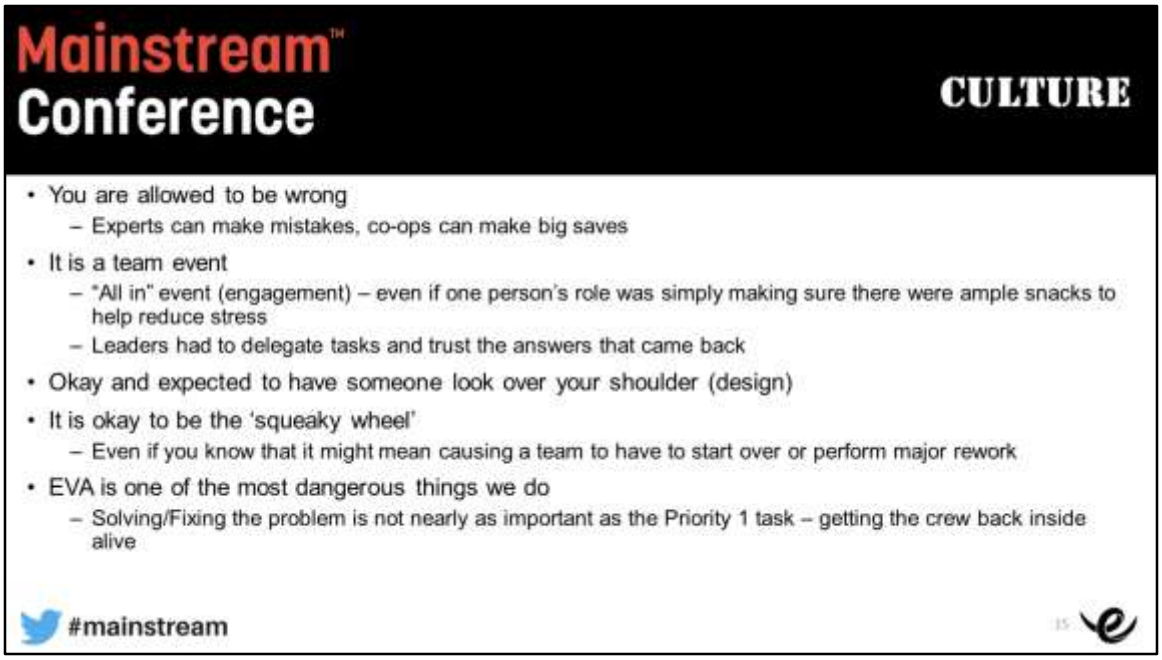
Big Picture: looking at the end to end process, and/or all the factors (system, vehicle, mission, environment, team, history, etc.). Someone who is looking across the 'stove-pipes'

Matrix Mgmt: by that I mean, all the people and teams that have a say in whether we are doing the right thing

FD and PM: processing the details with the mindset of integrating the entire big picture, along with serving as a type of 'check valve' on the overall process and progress. Their job is to challenge assumptions, ensure that situation was properly and completely assessed and the plan was been thoroughly coordinated and vetted.

EVA thought about the EVA differently than the SPARTANs than did the MER. Because they all had different MMs, they exposed holes in each others MMs, hopefully making sure that nothing got missed across teams

Within a discipline, everyone should have had a similar MM – everyone in EVA should have a similar MM on how to do an EVA. So when someone has a thought that something isn't right, it gives the team a chance to make sure that nothing got missed within the team, especially between shifts or tasks



0:01
Presentation PET 0:30

You're allowed to be the expert but still make mistakes. This allows egos to not be in the way. No blame as long as you learn

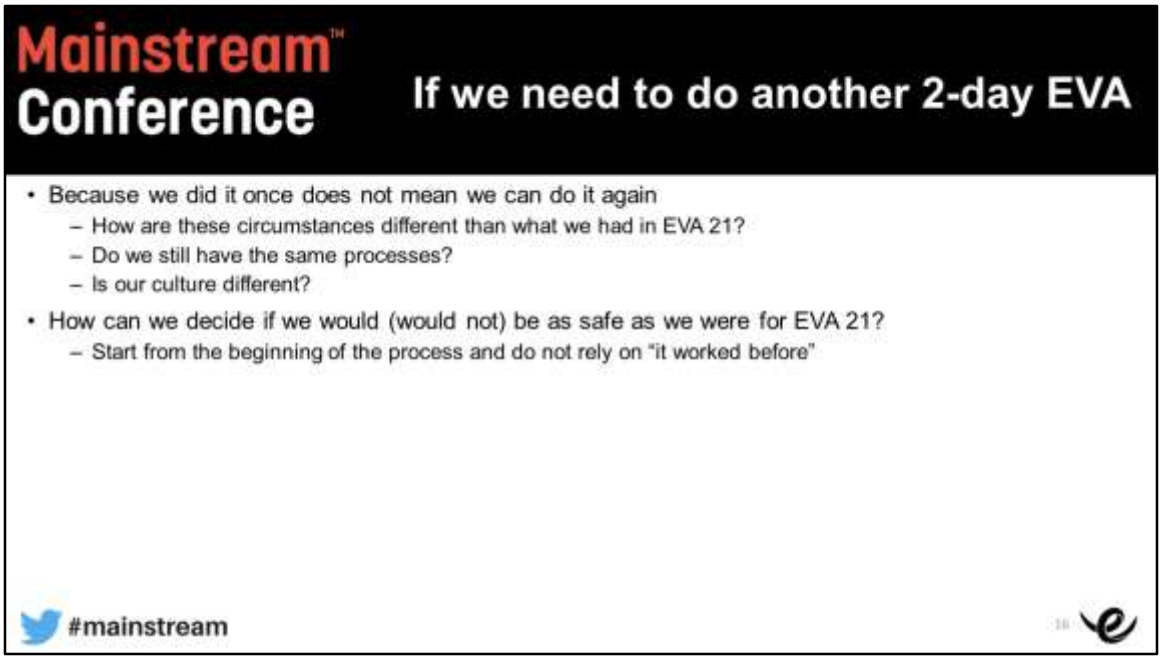
We didn't expect one person to do all the work: to be the hero to carry the entire project on his/ her shoulders
Everyone pitched in. People came in and offered to help. Sometimes just as little as bringing in snacks.
Leaders had the trust and confidence to delegate tasks

This is a 2 parter:
1) It is okay to have someone check your work without that being a sign we don't trust you
2) There is an expectation that it is okay for you to look over people's shoulder when you know they are stressed or tired or rushed, or when you know the task is safety critical or time critical

A short CRM briefing: it is your job to catch my mistakes, and it is my job to catch

yours

It is okay to say that you have an issue or don't think we are doing the right thing. It is even ok to be wrong about having an issue: it wasn't an issue at all. Saying: the safety mentality of an organization is not how they treat someone who stops the team when there was a problem, but how they treat the person who stops the team when there really wasn't a problem. Do you 'counsel' him (next time be sure before you stop the team) or thank him for having the courage?



0:02
Presentation PET 0:32

Would we still have tried if
1. If the FCer who was the expert was on vacation
2. If we hadn't done an EVA in over 6 months (no one had any recent experience)
3. The failure was more ambiguous

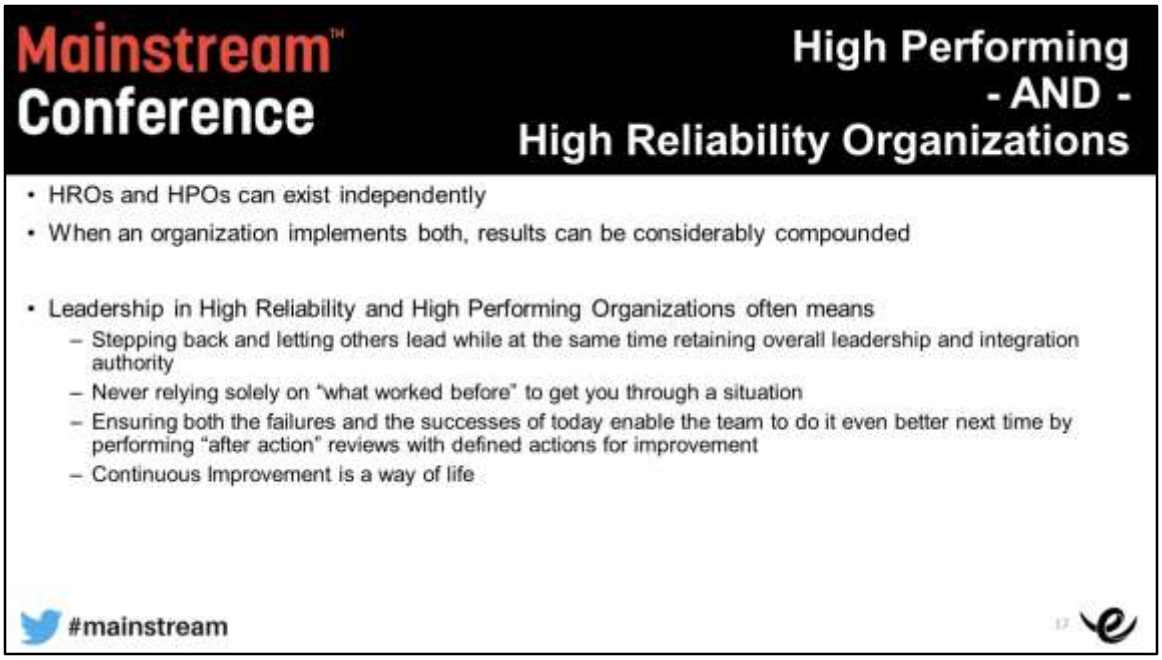
Cultures change very slowly overall but may be affected by intense pressure - What if we had only 1 day due to the leak size or the Soyuz schedule, would we have tried (I asked the answer is no)

But over time, as the 'Old Guard' retires is it possible for our culture to be less what we value in FOD?

FYI: two views on culture:
1) Something mgmt tries to steer/ instill
2) Something that emerges without plan over daily interactions

#1 gives the impression that mgmt can control culture; #2 says mgmt control may be minimal (the best they can do is notice the change and try to mitigate it at least over the short term)

Many of our ‘processes’ are not really ‘processes’ in the classic sense that they are vetted and documented (they are just too complex and context specific). More importantly people know their roles and people do what they should do and need to do keeps us safe. Will the next group of people know what they need to do, who they need to talk to about what, when and how?



0:02
Presentation PET 0:34

HROs alone work risk and safety well. HPOs do good things and can do them quickly and effectively. HPOs that are HROs are a rare breed but something all complex orgs should strive for. It means you can do good things quickly and effectively but also safely while managing risk. We're not perfect though, and that's part of the process – when you make mistakes (big or small), you learn from them. When you have successes (big or small) you don't just celebrate that it worked but you also learn the enablers so you can repeat your successes.

Leadership in High Reliability and High Performing Organizations often means

Stepping back and letting others lead while at the same time retaining overall leadership and integration authority

Trust but Verify

Never relying solely on "what worked before" to get you through a situation

But at the same time relying on established processes and culture to ensure consistency

Ensuring both the failures and the successes of today enable the team to do it even better next time by performing “after action” reviews with defined actions for improvement

Continuous Improvement is a way of life

Mainstream™ Conference

Contact Info and Websites

How to contact me:
Ed Van Cise
edward.a.vancise@nasa.gov

+1 281 483 9170
@NASA
@Space_Station
@Carbon_Flight
cflight78

https://youtu.be/wgdbZhnFD5g

http://www.nasa.gov/station

http://www.nasa.gov/astronauts

http://spotthestation.nasa.gov

https://www.linkedin.com/in/edvancise

https://www.facebook.com/carbon.flight

#mainstream

Video is 3:54